SHITAKE MUSHROOM GUDE FORNYC GARDENS



OVERVIEW

Shiitake (*Lentinus edodes*) is the second most produced mushroom variety in the world. It was originally harvested wild throughout Asia, where it was often found growing on fallen 'shii' trees. Over the last 50+ years, a lot of work has been done in China and Japan to develop shiitake cultivation techniques. These techniques have made it a possible to grow in various regions of the United States. And it's increasingly popular in NYC gardens!



PREPARING TO INOCULATE

PROCURING SUBSTRATE

NYC producers often grow shiitakes on **bolts**.

- Bolts are carefully harvested logs, 4-6" in diameter, usually cut to 36-40" lengths
- They should be produced from healthy, disease free, <u>living</u> wood
- For best results, bolts should have fully intact bark with no large holes, cuts, or gaps
- Hard woods, especially **Oak & Maple**, make the best bolts and yield the most shiitakes.
- Many recommend against making bolts out of soft woods like Pine. Black Locust, Elm, and Ash
 common NYC tree species - should also be avoided due to their anti-fungal properties.



PREPARING TO INOCULATE

When to harvest logs: <u>February or March</u> Winter or early Spring, before trees leaf out, is the ideal time to harvest. Logs harvest during in dormancy will be the most nutrient-dense.

When to inoculate: March or April

After harvesting, rest logs in the shade, away from sun and wind for 2-6 weeks. Inoculate any time after the resting period, and absolutely no longer than 6 month after harvesting,



Harvesting & inoculating logs at other times: In NYC, it's not uncommon for trees to fall during a heavy storm,

or to be removed for whatever reason, during the spring, summer, and fall months. Working with the opportunities that are present, no matter what time of year, makes a lot of sense. Especially when prized tree species like Oak are available!!

WHAT YOU WILL NEED

Drill-and-Fill Method

- Logs
- Shiitake sawdust spawn
- Specialized 12mm drill bit
- Inoculation tool
- Food grade paraffin (cheese) wax
- Heat source (for melting wax)
- Wax applicators (dauber or brush)
- Tank large enough for soaking logs
- Shade cloth or a mushroom blanket

INOCULATION STEPS

STEP 1: DRILL HOLES

Drill 12mm, 1" deep holes ~3-6" apart, following a diamond pattern, all the way around the log. Depending on log size, expect to drill anywhere from 35-50 holes per log *Use this diagram as a guide*:





STEP 2: FILL WITH SPAWN

At NYRP, we generally work with <u>sawdust spawn</u> and <u>inoculation tools</u> and these steps are specific to that process. Some also like to work with <u>plug spawn</u> and a hammer.





Break apart the spawn block, so that it no longer has any clumps. When possible, it's good to use gloves during this step to avoid contaminating the spawn.

Using an inoculation tool, first take a small amount of the broken up spawn, and then deposit it into the pre-drilled holes in the log.

PRO TIP: It is important to fill the holes just to the edge of the bark. Be careful not to over- or under-fill, which will make sealing more difficult. Sometimes, this may require a second 'pass' with the inoculation tool.

STEP 3: SEAL WITH WAX

Cover the holes immediately after filling in order to seal in moisture and avoid contamination. Use a dauber or paint brush to apply a generous amount of wax directly on top of each filled hole.

The wax should be very hot when applied (almost smoking) in order to ensure proper adhesion.

PRO TIP: Wax should look almost translucent when applied. If it turns white immediately, the wax has not adhered properly and may chip off during regular log handling. Try troubleshooting by increasing wax temperature.





STEP 4: STORE THE LOGS





The easiest log storage system for NYC growers is the <u>log cabin-style stack</u> (pictured above). It is best to store logs somewhere with lots of shade and consistently cool temperatures. Leaving logs in an area with soil is preferred over asphalt, as this helps prevent drying out. Use a perforated cover (i.e shade cloth) for additional protection from the sun and creatures.

It will take approximately 6-8 weeks for the fungi to get established and at least 6-12 months until the logs produce any fruit. When working with larger diameter logs or in challenging storage conditions, the process may take longer. Don't be discouraged if you don't see shiitakes after 1 year.

PRO TIP: Label logs with the inoculation date and spawn type to more easily track progress over the years

LONGER-TERM CARE

PERFORM MAINTENANCE SOAKS

When to soak: <u>May-September</u>

It is important to monitor moisture levels and to provide supplemental hydration by soaking during the hot and dry stretches of the year. In Fall, Winter, and Spring, cooler temperatures and consistent precipitation should ensure that the logs get the water that they need naturally.

Instructions for soaking:

Fully submerge the logs, using a large tub or tank, for approximately <u>1-3 hours at a time</u>. At NYRP, we perform maintenance soaks <u>once per month</u>



MONITOR LOG HEALTH

Check the ends of your logs regularly for separation of bark from the wood and/or cracking. Small cracks are an early sign of drying out. Large cracks and bark separation are a sign of deteriorating log health.

As time passes, look for white fungal growth on the ends of the logs. This is a sign of myceliation and an early precursor to the emergence of shiitake mushrooms. Sometimes the first mushrooms will pop unexpectedly! White fungal growth and/or spontaneous fruiting are signs that your logs are doing well.





HARVESTING

FORCE THE LOGS TO FRUIT

Shiitakes are popular with growers because the logs can be 'shocked' to encourage mushroom production. Generally, it's best to wait <u>~12 months</u> post inoculation before starting to shock the logs or *force fruit* them.

Instructions for the force fruiting process:

- Fully submerge logs in water for 12 24 hours.
- Remove logs and position them for harvest.
- Look for 'pins,' the first sign of fruit emerging, and essentially very small mushrooms, after 2 - 3 days.
- 5 7 days after the logs are removed from their soak, there should be harvest-ready mushrooms!



At NYRP, we have special vertical 'fruiting stands' that we use exclusively for harvest. If you are able to position your logs vertically during harvest moments, that is ideal. Otherwise, re-stack the log cabin with logs more generously spaced for easy access.





PRO TIP: Be mindful of non-human creatures in NYC that might be also be interested in your mushrooms. At NYRP, we've had encounters with squirrels, raccoons, slugs, and ants. Continuing to cover your logs with shade cloth during the force fruiting period will help with some of those creatures more than others.

REST THE LOGS

After getting a good 'flush,' or harvest, let the logs rest for 8 weeks. The resting step allows the fungi to recuperate, and ensures that healthy mycellium will continue to produce for 3–5 years. In the 9th week, it is acceptable to begin the force fruit process again.

HARVEST TECHNIQUE

Shiitakes are typically ready to harvest 5 – 10 days after forcing the logs with an extended soak, or after you see pinning on the logs. When a log starts to pin, most mushrooms on that log will mature on a similar timeframe and quickly. At NYRP, we generally harvest all the mushrooms from a fruiting log within 3–7 days after pinning starts.

What to look for:

- Gills of the mushroom are visible, while edges of the cap are still curled in, similar to the curviture of your upper ear.
- Should feel firm, tender and not dry.





RESOURCES

KEY TERMS

Mycelium: The vegeative part of a fungus, made up of white strands of "hyphae"

Spawn: Vegetative mycelium on a sterilized growing medium, such as sawdust (note, this is note the same as mushroom spores)

Flush: A group of mushrooms that fruit at the same time after a period of forcing

Shocking or Forcing: The process of triggering mycelium to produce fruit, or mushrooms

Bolts: Logs that are inoculated with mushroom spawn



THE JOURNEY OF A LOG

Month 0: April, Year 1

INOCULATION! At NYRP, most of the shiitake logs that we work with are inoculated in the month of April and we highly recommend you aim for this start date. Earlier is great, if you don't mind the cold. Later is OK but can present challenges.

Months 5-6: Sept+Oct, Year 1

Many shiitake species love temps right around 70 degrees. During the first fall, when temps drop into that range, there is a chance of spontaneous fruiting. STOP SOAKING THE LOGS UNLESS CONDITIONS ARE UNSEASONABLY HOT AND DRY.

Months 15-60: Years 2-5

Continue the cycle of monitoring, soaking in the summer, and force fruiting in the spring + fall. Not all logs will produce for 5 years, but some larger and healthier specimen might.

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Months 1-5: May-Sep, Year 1

After an incubation period of 6-8 weeks passes, soak the logs for the first time. Perform regular soaks at least once per month during the hottest stretch of summer. Monitor logs for bark separation, cracking, and other signs of drying out. Perform additional soaks as needed.

Months 7-12: Nov-Mar, Year 1

WINTER DORMANCY. In a best-case-scenario, it is cold enough in NYC that the logs freeze solid.

Months 13-14: Apr+May, Year 2

Attempt the force fruiting process for the first time, if you haven't already.

CHOOSING TYPES OF SPAWN

First and foremost, when purchasing shiitake spawn, purchase from a reliable and high quality source to ensure success. At NYRP, we love **Field & Forest Products** in Wisconsin!

There are lots of different things that to consider when picking from the range of spawn options. First, just like there are different kinds of substrate, there are different kinds of spawn. Generally, for the protocols and processes outlined in this guide, we'd recommend using <u>sawdust spawn</u> NOT grain spawn, plug spawn, or thimble spawn.

There are many different shiitake strains available in sawdust spawn. Some of these are *warm weather-adapted*, which should be better for relatively hot climates like NYC. Others are either *'wind range'* or *cold-adapted*.

At NYRP, we've had the best luck with <u>West</u> <u>Wind</u>, a wide range and drought tolerant strain that seems to handle the rough and tumble NYC weather best. It also tends to produce quickly, often yielding mushrooms 6 months after inoculation, during that first fall.



THE CONTENTS OF THIS GUIDE WERE ADAPTED FROM TWO EXCELLENT SOURCES:

Best Management Practices for Log-Based Shiitake Cultivation in the Northeastern United States: By SARE, Cornell Extension & the University of Vermont Extension

Field & Forest Guide to Growing Shiitake Mushrooms: Fieldforest.net



